

Banking on Weed Control

Weed management is a lot like health management: You have to choose between a preventive and a reactive approach. Do you wait until you're sick and then go to a doctor for medicine, or do you watch your diet and lifestyle to keep from getting sick in the first place?

A holistic, preventive approach can be applied equally well to weed management and to human health. It focuses on preventive practices and natural processes to regulate weed populations. Emphasis is placed on maximizing beneficial ecological processes within farming systems to maintain weed populations at low, manageable levels. This requires research to better understand weed biology and ecology. Several ARS labs are currently engaged in such work.

To avoid weed problems, farmers can either prevent weeds from growing and going to seed or create conditions that destroy weed seeds before the next crop is grown. Both approaches will reduce the number of seeds stored in the soil—weed seed banks, as they're known. As the article on page 14 explains, those seeds are the source of the weeds we see every year. For weeds as a group, there are typically about 1,000 seeds per square yard, although a farm field could have as many as 50,000 seeds per square yard from some species. Sometimes, a single weed plant—of pigweed, for example—can produce 500,000 seeds.

Unlike crop seeds, weed seeds retain their natural dormancy, which keeps them from sprouting all at once and risking total annihilation from bad weather conditions, like droughts or floods. Only a small percentage from each weed species sprouts each year. That percentage increases when weather conditions are right. Each species has its own weather trigger, and one bad day can trigger the buried weed seeds of one species to stay dormant that year. For foxtail, this bad day could be one that heats the soil to 90°F. For pigweed, it could be a day when the soil gets too dry. The same goes for common garden weeds like crabgrass and common purslane. The seeds shed from just one weed plant can come back to haunt farmers for years to come. ARS scientists are working to genetically control weeds' dormancy and destroy them with little or no herbicide. The weed seed collection discussed in the story on page 12 is a key tool to help us understand dormancy enough to someday control it.

Fortunately, many factors prevent weed seeds from lasting in the soil very long. About half the seeds present at any one time come from the previous year's weeds. The rest were produced over the previous 2 years or more. So, if farmers manage to control weeds for 1 year, they will automatically have about 50 percent fewer weeds the next. ARS scientists at Morris, Minnesota, are developing and refining computer

models that incorporate seed-bank dynamics to predict seedling emergence for better weed control.

These banks of weed seeds in the soil are subject to continual "deposits" and "withdrawals." To prevent deposits, farmers can take many simple measures before intervening with herbicides. For example, they can change conditions to keep weeds off balance. Since each weed species is adapted to particular crops and practices, such as tillage methods, farmers can plant a summer annual crop like corn or soybeans, followed by a winter annual crop like wheat, or a perennial crop like alfalfa grown for hay in rotation. This helps ensure that weeds can't find continuous seasons to emerge when they won't face intense competition from crops or be cut for hay. If they do emerge, chances are good they won't survive long enough to go to seed.

Another technique is to keep the soil covered with dense vegetation that will smother those weeds that do emerge. This can be accomplished by planting crop seeds in denser patterns or by growing cover crops during months when cash crops are not being grown.

Still another approach focuses on creating a favorable habitat for seed-eating creatures, such as ground beetles, ants, and birds. This can be done many ways, including with no-till, which leaves a mulch cover of plant residue in which seed eaters can thrive. The tree borders or vegetative buffer strips that are often planted around farm fields to filter out sediment and pesticides in runoff may also provide habitat. Increasing a soil's organic matter by adding compost or cover crops also encourages seed eaters that live on the carbon in organic matter.

Fortunately, the practices of sustainable farming—such as improving soil quality, maintaining high biodiversity, and continuously covering soil with vegetation—also provide better habitat for weed-seed eaters.

Continued research on weed biology and ecology will improve our understanding of how weed seeds are regulated in agricultural soils and help producers develop strategies for eliminating them before they become a problem.

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